

## CLAIMS

1. A polyvalent bifunctional catalyst, characterized by the fact that it comprises deposited on a support  $\text{TiO}_2$ , an oxide or a mixture of metallic oxides of  $\text{MO}_2$  type prepared by the reduction of the corresponding  $\text{MO}_3$  oxide(s).
2. A catalyst corresponding to claim 1, characterized by the fact that the metal(s) forming the oxide(s) are chosen from the group formed by W and Mo.
3. A catalyst corresponding to claims 1 or 2, characterized by the fact that the metallic oxide obtained by reduction on the support is  $\text{WO}_2$ .
4. A catalyst corresponding to claims 1 or 2, characterized by the fact that the metallic oxide obtained by reduction on the support is  $\text{MoO}_2$ .
5. A catalyst corresponding to any of the claims from 1 to 4, which is characterized by the fact that the metallic oxide(s)  $\text{MoO}_3$  which are reduced to  $\text{MO}_2$  are deposited on a support  $\text{TiO}_2$  which itself could be deposited on a substrate having larger surface area than  $\text{TiO}_2$ .
6. A catalyst corresponding to claim 5, characterized by the fact that the said substrate is preferably  $\text{SiO}_2$ ,  $\text{Al}_2\text{O}_3$  or a zeolite.
7. A catalyst corresponding to any of the claims from 1 to 6, characterized by the fact that the reduction process takes place under a gaseous flux containing at least hydrogen at temperatures between  $380^\circ\text{C}$  and  $550^\circ\text{C}$ , during at least 6 hours, at a flow rate between 0.010 l/min and 0.050 l/min, preferably 0.030 l/min, with a volum between 90% and 100% of hydrogen, preferably 99% hydrogen.
8. A catalyst corresponding to the claim 7, characterized by the fact that the reduction takes place under a gaseous flux containing hydrogen and a gaseous hydrocarbon compound which undergoes a chemical reaction using this catalyst.
9. A catalyst corresponding to claim 8, characterized by the fact that the gaseous hydrocarbon is present under a partial pressure range between 666.6 Pa and 1999.8 Pa, preferably 799.9 Pa.
10. A catalyst corresponding to any of the claims from 1 to 9, characterized by the fact that the oxide(s)  $\text{MO}_3$  are deposited in atomic layers on a support before being reduced to  $\text{MO}_2$ , this reduction process having no effect on the number of layers.
11. A catalyst corresponding to claim 10, characterized by the fact that the number of atomic layers of  $\text{MO}_2$  present on the surface of the support ranges between 1 to 8, preferably 5.
12. A catalyst corresponding to any of the claims from 1 to 11, characterized by the fact that it contains in weight 5.4% and 27% of  $\text{MoO}_3$ , which corresponds to 4.8% to 24% in weight of  $\text{MoO}_2$ .

-16-

13. A catalyst corresponding to any of the claims from 1 to 11, characterized by the fact that it contains in weight between 6% and 30% of  $WO_3$ , which corresponds to 5.7% to 28% in weight of  $WO_2$ .

14. A process for obtaining a catalyst corresponding to any of the claims from 1 to 13, characterized by the fact that it contains the following steps:

- To prepare a mechanical mixture from one or many  $MO_3$  oxides with  $TiO_2$  alone or  $TiO_2$  deposited on a substrate having larger surface area than  $TiO_2$ , this mixture containing an amount of the metal M which varies between 5% and 25%, preferably 22%,
- To crush the mixture prepared in the previous step, and
- To reduce preferably at  $460^\circ C$  the oxide(s)  $MO_3$ , thus deposited as corresponding  $MO_2$  oxides under a flux of a gas containing at least hydrogen over the oxides  $MO_3$ .

15. A process of realisation corresponding to claim 14, characterized by the fact that the step of depositing the oxide(s)  $MO_3$  takes place by mechanically mixing the crushed  $MO_3$  oxide(s) with  $TiO_2$  or  $TiO_2$  deposited on a substrate having larger specific surface area than  $TiO_2$ .

16. A process for obtaining a catalyst corresponding to any of the claims from 1 to 13, characterized by the fact that it contains the following steps:

- To wash the crude support, followed by drying and calcination,
- To crush the obtained solid, then sieving it,
- To deposit the  $MoO_3$  oxide(s) on the  $TiO_2$  support or  $TiO_2$  deposited on a substrate having larger surface area than  $TiO_2$  by impregnating the so called support with a solution metal M salt(s),
- To calcinate the obtained product in order to form the  $MO_3$  oxide(s), and
- To reduce preferably at  $510^\circ C$  the  $MoO_3$  oxide(s) to the corresponding  $MO_2$  oxides by passing a gaseous flux containing at least hydrogen over the  $MoO_3$  oxide(s).

17. A process of realisation corresponding to claim 16, characterized by the fact that only the particles diameters vary between  $80\ \mu m$  and  $400\ \mu m$  are kept following sieving.

18. A process of realisation corresponding to claims 16 and 17, characterized by the fact that the impregnation of the metal M salt(s) takes place for 2 to 4 hours, preferably 3 hours, at temperatures between  $50^\circ C$  to  $90^\circ C$ , preferably  $70^\circ C$ .

19. A process corresponding to any of the claims 16 to 18, characterized by the fact that in order to obtain  $WO_3$  then  $WO_2$  a tungsten salt, preferably  $(NH_4)_{10}W_{12}O_{41} \cdot 5 H_2O$ , is used.

20. A process corresponding to any of the claims 16 to 18, characterized by the fact that in order to obtain  $MoO_3$  then  $MoO_2$  a molybdenum salt, preferably  $(NH_4)_6Mo_7O_{24} \cdot 4 H_2O$ , is used.

21. A process corresponding to any of the claims 16 to 20, characterized by the fact that the impregnation of the support material takes place at a constant pH which is in the range between 1 and 4, preferably 2.

22. A process corresponding to any of the claims 16 to 21, characterized by the fact that the metal salt solution is in excess with respect to the support which is impregnated, the excess of the solution being evaporated in an oven after impregnation at temperatures in the range between 80°C and 120°C, preferably 100°C, for 10 to 14 hours, preferably 12 hours.

23. A process of realisation corresponding to any of the claims 14 to 22, characterized by the fact that the number of atomic layers of  $\text{MO}_3$  present on the surface of the support ranges between 1 to 8, preferably 5.

24. A process of realisation corresponding to any of the claims 14 to 23, characterized by the fact that the metal forming the oxides  $\text{MO}_2$  are selected in the group formed by W and Mo.

25. The use of a catalyst corresponding to any of the claims 1 to 13, possibly obtained by a process according to any one of claims 14 to 24, characterized by the fact that this catalyst is used in the reaction of isomerization, hydrogenation, dehydrogenation and / or hydrogenolysis of saturated hydrocarbons, especially alkanes.

26. The use of a catalyst corresponding to any of the claims 1 to 13, possibly obtained by a process according to any one of claims 14 to 25, characterized by the fact that this catalyst is used in the reaction of isomerization, dehydrogenation, hydrogenation and / or hydrogenolysis of mono or poly unsaturated hydrocarbons, especially alkenes and alkynes.

T000501 10230260

Add  
A1